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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,892	12/10/2003	Katherine L. Saenger	20140-00316-US	5181

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EXAMINER	
GEYER, SCOTT B	
ART UNIT	**PAPER NUMBER**
2812	

DATE MAILED: 06/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/730,892	SAENGER ET AL.	
	Examiner	Art Unit	
	Scott Geyer	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) *17-32* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,8,10,12 and 16* is/are rejected.

7)☒ Claim(s) *6,7,9,11 and 13-15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *121003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election of claims 1-16 in the reply filed on April 26th, 2005 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Information Disclosure Statement

The references cited in the IDS document filed on December 10, 2003 (paper no. 121003) have been considered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-5, 8, 10, 12 and 16 are rejected under 35 U.S.C. 102(a) as being anticipated by Mitsuhashi et al. (US 2003/0104706 A1).

As to **claims 1-5**, Mitsuhashi et al. teach a method of making an ultra-thin high-k gate dielectric. The high-k gate dielectric is deposited upon a substrate. The ultra-thin high-k gate dielectric is formed by thinning the deposited high-k gate dielectric material,

and the resulting thickness is between 1 to 3 nm (see paragraphs 0001 through 0069). The high-k dielectric material is made of hafnium oxide.

As to **claims 8 and 10**, Mitsuhashi et al. teach damaging a top portion of the hafnium oxide layer and then etching away the damaged portion (see figures 3A-3D).

As to **claim 12**, Mitsuhashi et al. teach the high-k dielectric material to be used as the gate dielectric. Therefore, after the gate dielectric is formed, a plurality of subsequent steps (i.e. post-thinning steps) will be performed to complete the semiconductor device.

As to **claim 16**, Mitsuhashi et al. teach annealing the high-k dielectric layer prior to the thinning process (see paragraph 0043).

Allowable Subject Matter

Claims 6, 9, 11, 13 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art of record and to the examiner's knowledge does not teach or render obvious, at least to the skilled artisan, the instant invention regarding:

depositing an interfacial layer of metal-free dielectric material between the substrate and the high-k dielectric material, as recited in claim 6;

using physical sputtering, ion beam etching, reactive ion etching or GCIB to remove the high-k dielectric material, as recited in claim 9;

utilizing an argon reactive ion etch as the damage treatment for the hybrid damage/wet etching treatment, as recited in claim 11;

a post-thinning treatment step of annealing in inert ambient, annealing in a reactive ambient and treating with plasma, as recited in claim 13;

adding additional material to the gate dielectric during or after the thinning step, wherein the material is form the group of material recited in claim 14.

The following references are cited as being particularly related to the applicant's invention:

Ho et al. (2004/0038538 A1);

Morisaki et al. (Ultra-thin (T_{eff}^{inv} = 1.7nm Poly-Si-gated SiN/HfO_2/SiON High-k Stack Dielectrics with High Thermal Stability (1050°C));

Ng et al. (Electrical Characteristics of Novel Hafnium oxide Film);

Zhan et al. (Characteristics of High Quality Hafnium Oxide gate Dielectric).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott Geyer whose telephone number is (571) 272-1958. The examiner can normally be reached on weekdays, between 10:00am - 6:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is

703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

6/1/05

Scott Geyer
June 1, 2005